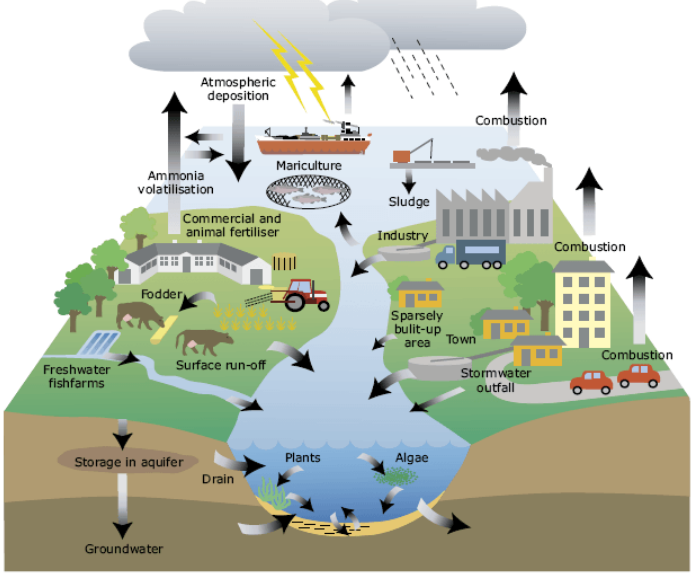
Pollution



- As per Environment Protection Act (EPA), 1986 “Environmental Pollution” is the presence of pollutant.
- Pollutants have been defined as any solid, liquid or gaseous substance present in such a concentration as may be or may tend to be injurious to the environment.
- The agents, which cause environmental pollution, are called pollutants. Pollutants are physical, chemical or biological substance intentionally or unintentionally released into the environment which is directly or indirectly harmful to humans and other living organisms.

What Is Pollution?

Pollution is defined as the addition or exessive addition of certain materials to the physical environment thereby making it less fit or unfit for living. These materials are called pollutants, and can be classified into various categories:

On the basis of	Type of Pollutant	Description
Form in which they exist	Primary Pollutant	That is emitted directly from the source. Example: Oxides of Sulphur and Nitrogen
	Secondary Pollutant	That is formed when pollutants combine with each other. Example: Ground Ozone, Acid Rain
Nature of disposal	Biodegradable Pollutants	These pollutants can be degraded by microbial action. Example: Sewage
	Non-Biodegradable Pollutants	These pollutants cannot be degraded and remain a part of the environment for a long period of time. Example: Plastic, Glass
Natural Vs Artificial	Natural Pollutants	They are already present in nature but become pollutants upon crossing a threshold concentration. Example: Carbon Dioxide
	Artificial Pollutants	These are artificially made by humans. Example: Herbicides, Pesticides, DDT
Physical Form of Existence	Particulate Pollutants	Example: Lead, Fly Ash Metallic Oxides, Nanoparticles
	Gaseous Pollutants	Carbon monoxide (CO) Carbon dioxide (CO_2) Chlorofluorocarbons (CFCs) Ozone (O_3) Nitrogen oxide (NO_x) Sulfur dioxide (SO_2)

Air Pollution

- Air pollution is defined as the introduction of pollutants, organic molecules, or other unsafe materials into Earth's atmosphere. This can be in the form of excessive gases like carbon dioxide and other vapours that cannot be effectively removed through natural cycles, such as the carbon cycle or the nitrogen cycle.

Particulate Pollutants	Gaseous Pollutants
1.Lead 2.Fly Ash 3.Metallic Oxides 4.Nanoparticles	1.Carbon monoxide (CO) 2.Carbon dioxide (CO_2) 3.Chlorofluorocarbons (CFCs) 4.Ozone (O_3) 5.Nitrogen oxide (NO_x) 6.Sulphur dioxide (SO_2)

Particulate Pollutants

- The particles that pollute the air by being suspended can be defined as particulate pollutants.
- These particles are results of some anthropogenic processes like vehicles, industries, construction sites/activities, etc. or natural sources like pollen, volcanic eruptions, natural gaseous precursors, etc.
- Their size ranges from 0.001 to 500 micrometers (µm) in diameter.

Heavy Particulate Matter	Suspended Particulate Matter	Nanoparticulate Matter
•More than 10 µm	•Less than 10 µm	•Less than 0.02 µm
•Settles down after a point	•Floats and moves freely with air currents	•Very light and harmful •Form aerosols

- Particulate pollutants can do vast damage to the human respiratory system.
- PM 2.5 particles (2.5 µm or less) are declared as one of the most harmful particulate pollutants by the Central Pollution Control Board (CPCB). They are so tiny that they can be detected only with the help of an electron microscope.
- These fine particulates can be inhaled deep into the lungs and can cause breathing and respiratory problems, irritation, inflammations, and pneumoconiosis (a disease of the lungs caused due to the inhalation of dust.

Lead

- Lead is one of the most hazardous heavy metals.
- Lead can cause serious damage to the human body like:
- Nervous system damage
- Digestive issues
- Kidney damage
- Impacts on intelligence
- Hence, Lead was banned as an additive to fuels and other products.
- Lead mixed with water and food can create cumulative poisoning.
- It has long term effects on children as it lowers intelligence.

Fly Ash

- Fly Ash is particles of oxides and other heavy metals. The majority of them are aluminum silicate (in large amounts), silicon dioxide (SiO_2), and calcium oxide (CaO).
- Thermal power plants are a major source of Fly Ash pollutants.
- Its deposition in agricultural fields can cause heavy metal contamination of crops and vegetables.
- The Ministry of Environment and Forests has made it mandatory to use Fly Ash-based products in all construction projects, road embankment works, and low lying landfilling works that are within a 100 km radius of Thermal Power Stations and mine-filling activities within a 50 km radius of Thermal Power Stations.

Major air Pollutants	Sources	Effects
Sulphur Dioxide (SO_2)	•Coal-based thermal power plants •Paper, Metal smelting industries	•Contributor to Smog and Acid Rain •Eye and throat irritation •Cough and allergies •Impairs enzyme function in the respiratory system •Reduces the exchange of gases from the lung surface.
NOx (Oxides of Nitrogen)	•Thermal power plants •Industries •Vehicles	•Irritation and inflammation of lungs •Breathlessness

CO (Carbon Mono-oxide)	•Incomplete burning of carbon-based fuels •Combustion of natural and synthetic products	•Lowers the amount of oxygen entering our blood •Slows down natural reflexes •Headache and unconsciousness, in severe cases, can cause death.
CO2 (Carbon Dioxide)	•Burning of fossil fuels	•Greenhouse Gas (Causes global warming) •Impairs reflexes •Causes carbonic rains in areas with higher concentrations of CO2.

Benzene	•Found in petrochemicals and used as a fuel additive	•Increases cancer risk and a major cause of bone marrow failure.
Ethylene	•Used in plastic and chemical industries in the production of Polyethylene and other polymers.	•Excess exposure can cause headaches and dizziness.
Asbestos	•Occurs naturally as a fibrous mineral. •Asbestos mining and sheet manufacturing	•Prolonged exposure and inhalation can be very harmful. •Can cause asbestosis and respiratory problems.
Mercury	•Industrial emissions and waste	•Can cause life-altering diseases like Minamata, Gingivitis, Tremor, Insomnia, Nervous disorder, and memory loss.

Chlorofluorocarbons (CFCs)	•Used in refrigerators, air conditioners, aerosols, etc.	•Highly destructive to the Ozone layer.
Ozone (O3)	•Very useful in the Stratosphere but harmful at the ground layer. •It's produced due to industries and vehicles. •Greenhouse gas.	•Has toxic effects. •Causes watery and itchy eyes.

Radioactive Pollutants	•Includes Radon, Radium, Cosmic Rays, Beta Rays, X-Rays	•Leukemia (Blood Cancer) •Permanent Genetic Changes •Affects cell membrane and cell enzymes

Government Interventions For Air Pollution

Name of the Programme	National Air Quality Monitoring Programme	National Air Quality Index	SAFAR (System of Air Quality and Weather Forecasting and Research)
Launched In	1982 (Revised in 1994 and 2009)	2015	2019
Executed By	Central Pollution Control Board	Central Pollution Control Board	Introduced by the Ministry of Earth Sciences, SAFAR is developed by the Indian Institute of Tropical Meteorology (IITM), Pune, and is operationalized by the India Meteorological Department (IMD).